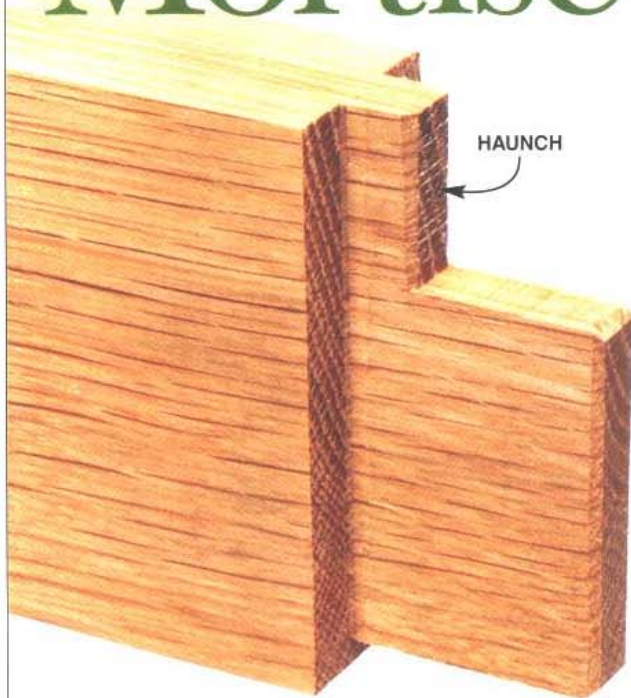


Haunched Mortise & Tenon



13 STEPS FOR MAKING A SUPER-STRONG JOINT.

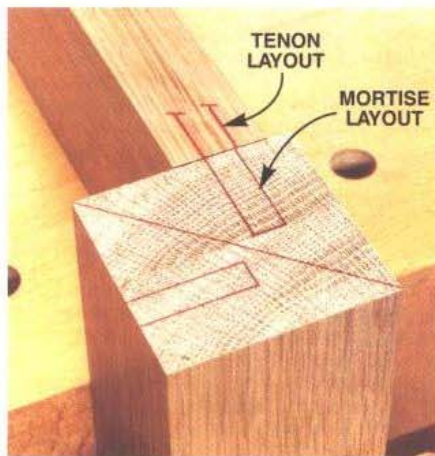
Of all the variations on the mortise and tenon joint, this is one of the best. The haunch – that short little stub tenon at the top of the joint – adds strength and rigidity.

A haunched joint can be used in many applications, such as door frames, paneled rail-and-stile assemblies, and table legs and rails. Here, we're going to build a generic leg and rail joint, using tools you'd find in a well-equipped small shop.

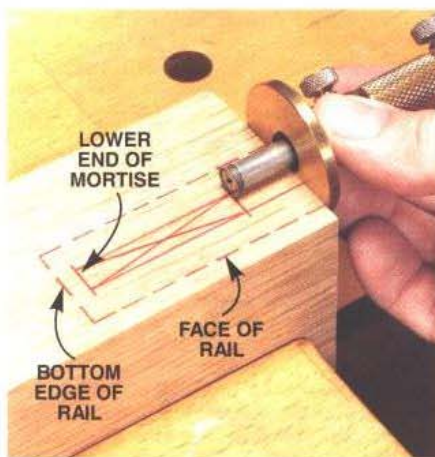
There are lots of ways to machine a haunched mortise and tenon joint. I settled on this system because it's accurate, reliable and can be easily adapted to joints large or small.



A **haunch** strengthens a standard mortise and tenon joint in two ways: it helps prevent the rail from twisting and increases the joint's glue surface area.



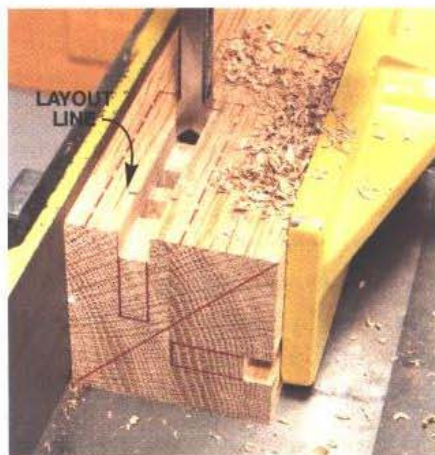
1 Begin by laying out the mortises. Draw a diagonal line across the leg's end to determine each mortise's maximum depth. The joint will be stronger if the mortises don't meet.



2 Lay out the mortise's haunch and lower end. It's a good practice to position the lower end above the rail's bottom edge. This way, the rail will fully hide the mortise.



3 Rout a shallow groove to begin making the mortise. Use a stop block to control the groove's length and a rounded board, clamped to the table, to hold the leg tight against the fence.



4 Chop the mortise using a mortising machine. The groove helps to guide the chisel. Use stops or the layout lines you made above to position the chisel at the mortise's ends.

LAY OUT A MORTISE

A good rule of thumb: always begin by making the mortises. It's a lot easier to fine-tune a tenon to fit a mortise than the other way around.

Mill stock for the legs and rails. Cut the legs to exact length, but leave the rails extra-long.

Determine the depths of the mortises (Photo 1). Draw a line from corner to corner on top of one leg. Draw a partial tenon on the end of one rail, to indicate its position and thickness. Continue these lines across the leg to locate the mortises. Draw the bottoms of the mortises, leaving some solid wood between them.

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Lay out the mortise (Photo 2). In most cases, the haunch should be at least 1/2-in. down from the top of the leg. Shortening this distance could weaken the joint, depending on how easy the wood is to split and the amount of stress on the joint. Use a marking gauge for the most precise and foolproof method to draw these layout lines.

Mark the lower end of the mortise on the leg. Begin by marking the rail's width. Start the mortise 1/8 in. or so above this line.

MAKE THE MORTISES

Mortising is a two-step operation. First, you'll use a router table to create a shallow groove to accommodate the tenon's haunch (Photo 3). Later on, you'll deepen part of the groove using a mortising machine.

Set up the router table with a straight bit that matches the desired thickness of your tenons. Raise the bit to the depth of the haunch. There are no hard and fast rules here, but generally the haunch's depth is the same as its width. Clamp a stop block to limit the length of the cut, which should extend the full length of the mortise.

For the best results, always push the leg into the bit from the right-hand side of the router table—that is, from right to left. The bit's rotation helps

hold the leg tight against the fence, ensuring a straight cut.

You'll have to reposition the fence for half the mortises. Begin by making one set of mortises. Then, unplug the router, remove the stop and move the fence out of the way. Turn one of the legs around and place its mortise over the bit. Move the fence up to the leg and clamp it down. Replace the stop and rout the remaining mortises.

Move on to a mortising machine (Photo 4). Set the chisel's depth according to the layout on the leg's end. Mortising is a three-step operation. First, cut the outer two holes, right on the gauge lines. Second, make holes in between, spaced by about half the chisel's width. Third, center the chisel on the waste areas between the holes and finish the mortise. (For more information on using a mortising machine, see AW #128, May 2007, p. 82.)

CUT THE CHEEKS

Now that you've established the mortise's depth, calculate the length of the tenon. A tenon should not bottom out in a mortise, so there's room for glue to puddle; plan on a gap of 1/16 to 1/8 in. between the end of the tenon and the bottom of the mortise. Once you know the tenon's length, cut the rails to exact size. Draw a tenon all the way around one rail.

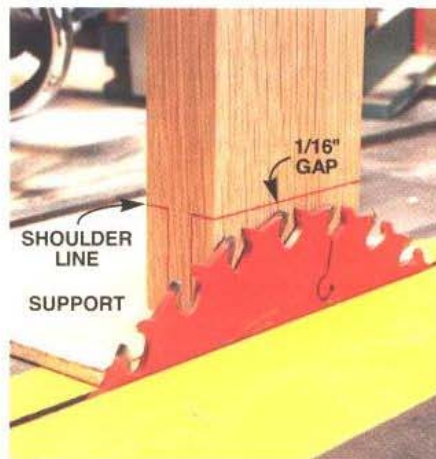
There are many methods to cut tenons, but one of the best begins by using a tenoning jig on your tablesaw. It's quick and accurate. You can make your own tenoning jig (see AW #88, Aug. 2001, p. 67), or buy a commercial one for as little as \$60 (see AW #123, Sept. 2006, p. 84 for a comparison of models).

One of the slickest ways to use a tenoning jig is to cut both cheeks without re-adjusting the fence. The key is a spacer whose thickness exactly equals the width of the mortise plus the thickness of your sawblade's kerf. If your mortise is 3/8 in. wide, for example, and your blade cuts a 1/8 in. kerf, make the spacer 1/2 in. thick. You may have to adjust the spacer's thickness for a perfect fit, so it's a good idea to saw a tenon on a test piece first. Once you've made the spacer, you can re-use it for future projects to save setup time.

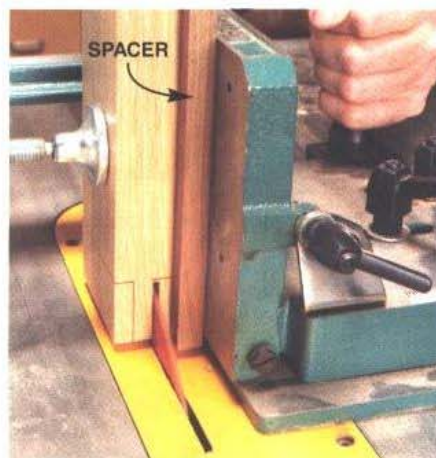
To begin, raise the blade to the correct height (Photo 5). Place the spacer and rail in the jig, with the rail's outside face placed against the spacer. Stand both pieces on the support board and tighten the jig's clamp. Remove the support board.

Adjust the jig right or left until the sawblade aligns with the tenon's layout line. Saw the rail (Photo 6). Turn off the saw and unclamp the spac-

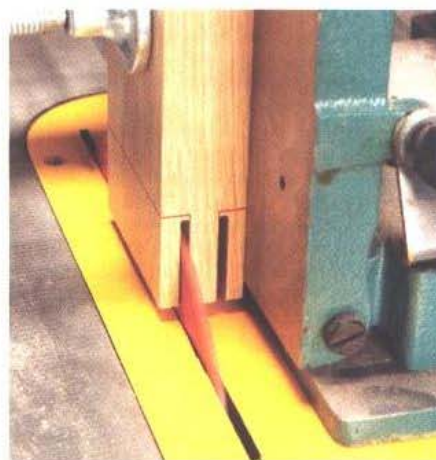
5 Make the tenon using a tenoning jig, which holds the rail vertically. Stand the rail on a support board, which you'll remove before sawing. Raise the blade 1/16-in. below the tenon's shoulder.



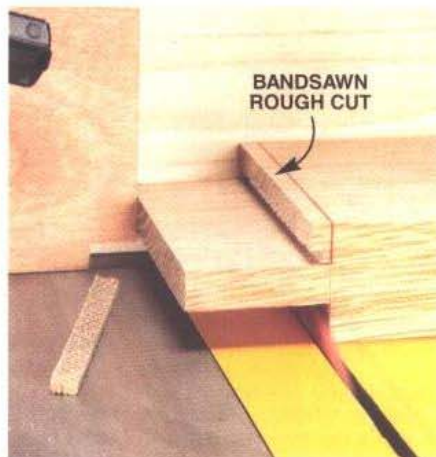
6 Clamp a spacer board between the rail and the jig. Remove the support board, so the rail and spacer sit above the saw table. This prevents them from dragging and tipping as you cut. Saw the first cheek.

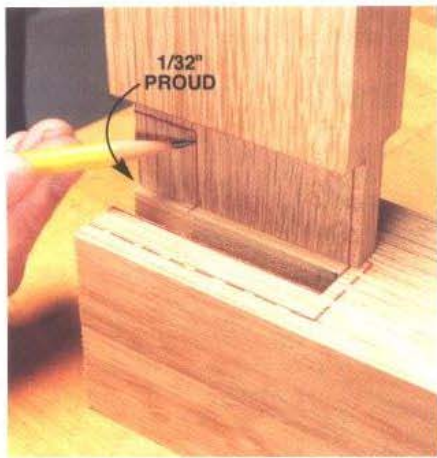


7 Remove the spacer to cut the tenon's other cheek. The spacer method frees you from fiddling with the jig to fine-tune the tenon's thickness. Keep the spacer for making more joints this size in future projects.

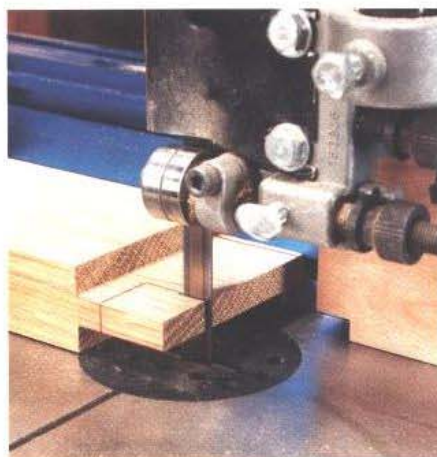


8 Saw the tenon's shoulders using a miter gauge and a stop block. The cutoff pieces are a potential kickback hazard. Remove most of the waste first, using the bandsaw.





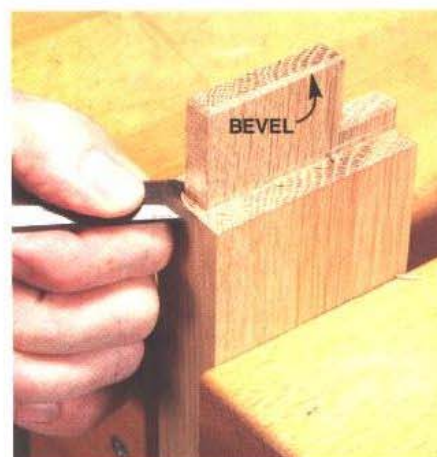
9 Lay out the haunch and bottom of the tenon. Stand one rail on a mortise and transfer the layout lines. To aid in leveling the joint later on, position the rail 1/32 in. above the leg's end.



10 Make two rip cuts using the bandsaw and a fence. With a sharp blade, the cut surfaces will be sufficiently straight and smooth for a good joint. Use a stop block to avoid cutting too far.



11 Crosscut the haunch using a miter gauge. The haunch should be 1/32 in. or so shorter than the depth of the mortise's groove. This ensures that the rails' shoulders butt against the leg.



12 Pare the small shoulder below the tenon. One advantage of a haunched joint is that you don't have to pare end grain above the tenon, too. Bevel the tenon to make glue-up easier.

er and rail. Set aside the spacer. Stand the rail on the support board again and clamp the rail to the jig. Remove the support and saw the tenon's other cheek (Photo 7).

Cut off the waste pieces on the bandsaw and test the tenon's fit. It should slide into the mortise without much resistance. If it's too tight, plane or joint the spacer to make it thinner. If the mortise is looser than the thickness of a piece of paper, add masking tape or paper to the spacer to make it thicker. Cut another test piece before sawing your project's pieces.

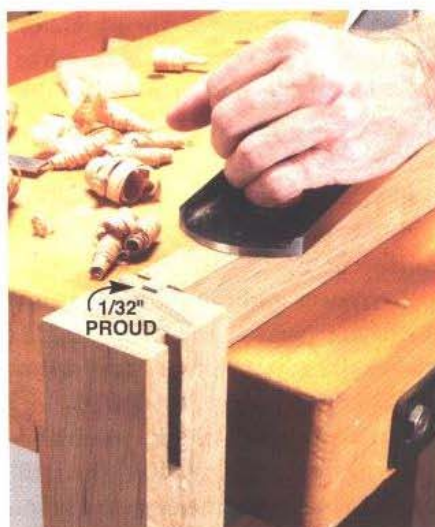
CUT THE SHOULDERS AND HAUNCH

Saw the tenon's shoulders (Photo 8). Depending on whether your tenon is centered or not, you may have to adjust the blade's height for each side.

Use the bandsaw to cut out the haunch and the tenon's bottom edge. Transfer the leg's gauge lines to the tenon (Photo 9). Set up the bandsaw's fence and a stop block to make these two rip cuts (Photo 10). Use a miter gauge and stop block to crosscut the haunch (Photo 11). A single setup will work for both ends of the rail for all three cuts.

At the bottom of the tenon, you're left with only a small sliver to crosscut. It's difficult to bandsaw this piece precisely flush with the tenon's shoulders, so it's best to make the cut slightly proud. After you're done sawing, clamp the rail in your bench and pare this shoulder with a chisel (Photo 12). At the same time, bevel the ends of the tenon to make it easier to insert into the mortise during glue-up.

It's best to take the glue-up in stages, first gluing opposite pairs of legs and rails. When these assemblies are dry, clamp them in your bench and even up the tops of the rails with the legs (Photo 13). Plane in from each end, so you don't chip off part of the leg.



13 The rails should be proud after gluing. Plane them flush. This safety margin avoids having to level the leg's tough end grain, in case the rails ended up too low.